Dioxin Factories

A summary of reported industrial releases of dioxin in NSW

June 1996

GREENPEACE

ERRATA
Page 9 paragraph 4: the first sentence should read "With the exception of the Sydney Harbour Tunnel, most of the ambient air levels recorded..."
Page 9 Table 5: the figure for the Castlereagh landfill ambient air level that reads 0.168 pg ITEQ m^{-3} should read 0.0168 pg ITEQ m^{-3}.

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Dioxin Factories

A summary of reported industrial releases of dioxin in NSW

This report presents data obtained by Greenpeace under the Freedom of Information (FOI) Act 1989 from the NSW Environment Protection Authority (EPA) about releases of the extremely toxic chemical dioxin from motor vehicles and 14 sites around NSW. The report shows that six out of eight of these "dioxin factories" that were still operating had dioxin emissions above German standards. These results further demonstrate that, under our present laws, companies can secretly pollute the environment with toxic chemicals without fear of public scrutiny or regulatory action. The report supports the need for a mandatory National Pollutant Inventory and highlights the need for legislation to eliminate dioxin.

The data presented in this report only captures a small number of the potential sources of dioxin. There were many other possible significant sources not investigated including pulp mills, PVC manufacture, pesticide/herbicide manufacturer, oil refining, electric arc steel furnaces and other metal recycling operations.

1. The Toxicity and Impact of Dioxin

In reassessing the toxicity of dioxins, the US Environmental Protection Agency has indicated that there may be no safe level of dioxin exposure.

Definitions

ITEQ	International Toxic EQuivalents based on the toxicity of 2,3,7,8-TCDD (the most toxic form of dioxin).
NATO and Eadon	are two different ways of estimating the toxicity of the non 2,3,7,8-TCDD chloro-dioxins and furans
$ng\ m^{-3}$	nanograms per cubic metre
$pg\ m^{-3}$	picograms per cubic metre
ADI	Acceptable Daily Intake
TDI	Tolerable Daily Intake
WHO	World Health Organisation
ANZECC	Australia and New Zealand Environment and Conservation Council
SPCC	State Pollution Control Commission
EPA	Environment Protection Authority
CCO	Chemical Control Order

June 1996

Printed on Totally Chlorine Free paper

What are Dioxins and Furans?

The term "dioxins" refers to a class of compounds consisting of 75 chlorinated dibenzo-*p*-dioxins (PCDDs) and 135 chlorinated dibenzofurans (PCDFs). Although similar in structure, the 210 PCDD and PCDF congeners differ considerably in toxicity, with 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) being the most toxic in laboratory animals.

The Route to the Top - how dioxins invade our bodies.

Dioxins, like many other organochlorines, are lipophilic substances, ie they are fat-loving. As most of the fat reservoir of the planet exists in living organisms, the biosphere selectively filters such substances out of the greater environment and stores them in body tissues. In other words, living organisms are like sponges: they soak up dioxins from the water they drink, the food they eat and the air they breathe. Dioxins are generally resistant to degradation by biological processes, and tend to bioaccumulate in the tissues. This leads to biomagnification in the food chain. As the chemicals move up the chain in contaminated food, they accumulate in larger quantities relative to the body mass of the organism.

It is therefore no surprise that, due to our position at the top of the food chain, human exposure to dioxins is almost exclusively from food intake, especially meat, fish and dairy products. Vegetarians who eat no meat or fish have considerably lower exposures.[1]

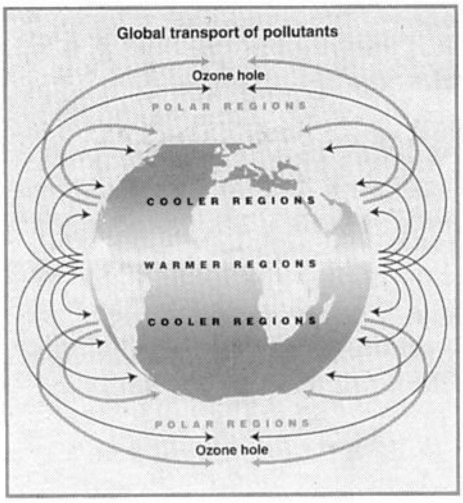
Global Accumulation of Toxic Chemicals

Emissions of toxic compounds into the atmosphere results in their long range transport from the populated tropical and temperate regions to the colder, polar regions where they are deposited into the soil and water. To a lesser extent, oceanic currents also contribute to the transport and concentration of pollutants at the poles. This is known as the global distillation effect (see diagram).

Numerous studies have indicated the global scale and severity of toxic contamination of all living things and entire ecosystems. Fish, reptiles, birds and mammals, including humans, are all affected. Dioxins are found in all environmental media, including air, soils, water, plants and animals. Once deposited, dioxins are slow to degrade, are relatively immobile, and accumulate in soils and sediments.[2] It is estimated that even if production ceases, levels in the environment will take years to decrease. This is because dioxins are persistent, taking decades or centuries to degrade, and are capable of being continually recycled throughout the environment.[3]

Health Impacts

Studies of laboratory animals, and human health trends following accidental or occupational exposure, have shown that dioxin can affect development, reproduction and the immune system. Dioxin can also cause cancer. Even more disturbing are findings from recent studies which reveal that concentrations of dioxins in human tissue in the general population of industrialised countries are already at - or near - those where health effects may occur.



Hormone Disrupters

Hormones are the chemical messengers which control or mediate vital bodily functions. The hormonal system also regulates the development of vital functions in the foetus, such as the reproductive organs, the immune system, intelligence and behaviour.

Synthetic chemicals which mimic hormones within the body can exert their effects in different ways. Many mimic the female hormone, oestrogen, while others are anti-oestrogenic, in that they block the normal biological response to the body's own oestrogens. Androgenic hormones mimic or block the male hormone, testosterone. Unlike natural hormones, which are rapidly broken down once the desired effect has been produced, hormonal pollutants remain in circulation and can effect the same reaction over and over again, creating havoc in the finely tuned human body.

The plastic polyvinyl chloride (PVC) is the source of two hormone pollutants: dioxin, which is formed as an unwanted by-product during the production and combustion of PVC; and phthalates, which are used as additives to make PVC soft and flexible.

For more information on Hormone Pollution see Greenpeace Report: Taking Back our Stolen Future; Hormone Disruption and PVC plastic, April 1996.

In summary, recent research on the health effects of dioxin indicates the following: [a]

1. ***In fish, birds, mammals and humans, the developing foetus/embryo appears to be very sensitive to the toxic effects of dioxin.*** Developmental effects in humans, seen after high accidental/ occupational exposure to dioxins include: decreased growth; functional alterations (eg effects to the male reproductive system, impairment of intellectual development); and organ dysfunction.

2. ***Animal and/or human studies have shown that some effects, for example cellular changes in the immune system, changes in the levels of male sex hormone testosterone,*** and changes in other enzymes and hormones, may be occurring in humans at, or near to, current levels or "body burdens" of dioxins found in the general population of industrialised countries.

3. ***Biological effects from dioxins appear to depend on the concentration present in a target organ over a critical time period rather than on dose.*** Animal experiments have shown that exposure to very low doses of dioxin during extremely short, critical periods during gestation is sufficient to cause detrimental health effects in the foetus.

4. ***In industrialised countries, levels of dioxin in breast milk often result in nursing infants having dioxin intakes far in excess of the Tolerable Daily Intake (TDI) proposed by the World Health Organisation (WHO).*** This becomes of even greater concern when one considers that risk assessments for health from dioxin exposure do not take into account exposure to other chemicals. The effects of these other chemicals on health may be synergistic with dioxin, ie. produce a larger than additive enhanced effect.

5. ***Evidence from both studies of occupational or accidental exposure to dioxin and animal tests indicates that dioxin causes cancer in humans.*** The US EPA has estimated that current background exposure to the general population results in cancer risks ranging from 1 in 1000 to 1 in 10,000.[4]

6. ***Body burdens of dioxin in the populations of industrialised countries are generally higher than those of people in less industrialised countries.*** Due to the global distillation phenomenon (see p.3), even if all dioxin emissions were to be immediately stopped, the deposition and contamination of the populations of colder climates would continue to increase for the foreseeable future.[5]

Dioxins are endocrine disrupters; they interfere with the hormonal system[6] (see box). It has been found that dioxin triggers the activity of hormones designed to turn on or off certain biochemical functions within the body, particularly in the reproductive system. By blocking the actions of oestrogen or altering other hormones, dioxin could disrupt reproduction or sexual development in humans or wildlife.

It is becoming clear that the effects of "environmental hormones" are triggered at extremely low levels of exposure. The subtlety of these changes is extremely worrying: female rats given just one dose of dioxin on a particular day of pregnancy had male offspring with lowered levels of testosterone,[7] reduced sperm counts[8] and feminised sexual behaviour.[9]

Abnormalities in brain function and the immune system have been reported among children who experienced elevated perinatal exposure to dioxins.[10,11] The immune systems of infants who had exposure, via the placenta or breast milk, at the higher end of the typical range of exposure for the Dutch population were significantly different from those at the lower end of this so-called background level. In addition, their psychomotor scores were lower at three months of age and their neurological condition showed slight impairment at 18 months of age.[12]

A study of German chemical workers suggests that dioxin causes both cancer and ischaemic[b] heart diseases.[13]

A 1992 study for the Australian Federal Government on premature mortality in NSW showed elevated levels of death from leukemia and lymphomas in inner Sydney. Some of the highest levels of leukemia and lymphomas occurred in Sydney City and Waverley, prompting concern

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[a] For more information on the human health impacts of dioxin and other organochlorines see Greenpeace Reports: (i) *Achieving Zero Dioxin; An Emergency Strategy for Dioxin Elimination*, September 1994; (ii) *Body of Evidence: The Effects of Chlorine on Human Health*, May 1995.

[b] Ischaemic - tissue damage and localised death due to lack of oxygen.

over the location of the Waterloo municipal waste incinerator as being "of some interest - particularly given community anxieties about the health implications of toxic emissions of dioxins and furans." The study, by Professor Peter Curson of Macquarie University, called for further investigation.[14]

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2. The Major Global Sources of Dioxin

Dioxin and Chlorine Chemistry

Dioxin is not manufactured on purpose but is formed as an unintentional by-product in many processes in which chlorine and chlorine-derived chemicals are produced, used, and disposed of. The major primary sources of dioxins include combustion processes, especially municipal waste incinerators, and industrial processes, such as the pulp and paper industry and the manufacture of organic and inorganic chlorinated chemicals.

Incineration of municipal, hazardous and hospital waste is generally considered to be the major source of dioxin emissions to air. In some countries, such as the Netherlands and the United States, dioxin emissions from incinerators are thought to make up between 80-95% of all atmospheric emissions.[15] PVC manufacturing, steel smelters, motor vehicles and house fires are also sources of dioxin to air. These estimates do not take into account dioxins which reach the environment through aquatic discharges or other routes, such as in the effluent from PVC manufacturing processes and in residues from dry-cleaners.[16]

The Link between PVC & Dioxin

PVC is the single largest user of elemental chlorine. One of the most common plastics, PVC is used in numerous different products. The largest quantity is used in building materials, such as cables, floorings, window frames, water pipes and wallpapers. It is also used in packaging, furniture and children's toys. PVC is linked in numerous ways with the formation and release of dioxin, as follows:

a) Manufacturing by-products

It has been known since 1989 that dioxin is produced in the manufacturing of the chemicals from which PVC is made. Dioxins are generated in the oxychlorination process, a fundamental step in PVC production.[17]

ICI, a major player in the PVC industry in the UK and Australia, has acknowledged that dioxins are the unavoidable byproducts of the oxychlorination process used in making the PVC feedstock, ethylene dichloride (EDC),[18] while a US PVC manufacturer has admitted that PCBs are also unavoidable byproducts.[19]

In 1995, Greenpeace gathered and analysed waste samples from US manufacturers of PVC feedstock, EDC and vinyl chloride monomer (VCM). These waste samples were found to be extremely highly contaminated with dioxins.[20]

b) Accidental fires

PVC causes dioxin formation at accidental fires, when PVC is present in building materials or furnishings. The German EPA recommended "in the long run, PVC products should be substituted by other materials in all areas where the potential for dioxin and hydrogen chloride formation in case of fire poses a substantial risk for human health and the environment."[21]

On Friday, April 12, 1996, sixteen people died and more than one hundred were injured in a fire at Germany's second biggest airport in Düsseldorf. PVC-coated cables and other materials emitted dense black smoke with high emissions of hydrochloric acid and dioxins. According to the fire department, the victims were killed by inhaling toxic fumes, that were formed because the PVC that was available throughout the building caught fire.[22]

c) Recycling and Disposal

During the recycling or disposal of products containing PVC, dioxins can be released. Numerous PVC compounds, or combinations of PVC with other materials, have been identified as potential dioxin sources. These include PVC + paper (eg. wallpaper), PVC + copper (cables), PVC + steel (cars), etc.[23]

PVC fire kills 16

On Friday, April 12, 1996, 16 people died in a fire at Germany's Düsseldorf airport - killed by inhaling toxic fumes from burning PVC that was throughout the building.

Groundwater Pollution from PVC manufacture

Greenpeace is presently taking legal action in Victoria to obtain information about the contamination of groundwater from PVC manufacturing by chemical companies Dow Australia Ltd and Auseon Pty Ltd during the 1960s and 1970's in Altona in Melbourne's Western Suburbs. Greenpeace is concerned that the studies of contamination have not looked for dioxins and PCBs and hence not properly assessed the potential human and ecological impacts of the contamination.

Table 1: Processes that form Dioxins and related Chemicals.

Production of chlorine gas

- Chlorine electrolysis with graphite electrodes
- Chlorine electrolysis with titanium electrodes

Uses of chlorine gas

- Pulp and paper bleaching
- Manufacture of chlorinated aromatic hydrocarbons (pesticides, dyes, specialty chemicals, others)
- Manufacture of chlorinated solvents (trichloro-ethylene, tetrachloroethylene[①], carbon tetrachloride[②])
- Manufacture of PVC plastic feedstocks (EDC, VCM)
- Manufacture of other organochlorines (epichlorhydrin, hexachlorobutadiene)
- Manufacture of some inorganic chlorides (ferric and copper chlorides, sodium hypochlorite)
- Disinfection of drinking water and wastewater
- Manufacture of refined metals with chlorine (Ni, Mg)

Uses of organochlorines

- Synthesis of chlorine-free chemicals with chlorinated intermediates (nitrophenols, parathion, others)
- Degreasing with organochlorine solvents in alkali or reactive environments
- Oil refining with organochlorine catalysts
- Use of pesticides with heat (wood treatment, etc.)
- Iron/steel sintering with organochlorine cutting oils, solvents, or PVC plastics
- Burning gasoline or diesel fuel with organochlorine additives

Waste Incineration, Recycling, and Fires (primary dioxin precursor)

- Medical waste incinerators (PVC)
- Municipal waste incinerators (PVC)
- Hazardous waste incinerators (solvents, chemical manufacturing wastes)
- Cement kilns burning hazardous waste (solvents, chemical manufacturing wastes)
- Aluminium recycling/smelting
- Steel and automobile recycling/smelting (PVC)
- Copper cable recycling/smelting (PVC)
- Wood burning (pentachlorophenol wood preservatives, PVC)
- Accidental fires in homes and offices (PVC)
- Fires at industrial facilities (PVC, PCBs, other chlorinated chemicals)

Environmental transformation

- Transformation of chlorophenols to dioxins in the environment

① trichloroethylene & tetrachloroethylene are more commonly formed from EDC tars rather than direct use of chlorine

② carbon tetrachloride use is being phased out under the Montreal Protocol.

From "Achieving Zero Dioxin: an emergency strategy for dioxin elimination", Greenpeace International, 1994.

Other sources of dioxins from the disposal or recycling of PVC include:

- Vinyl wallpaper and furniture is often burned in the open by individuals in their back yards, or by companies in inadequate furnaces that are not suited at all for burning such hazardous wastes.[24] The German EPA requires all furnaces, from household fires to industrial furnaces, to be free of material containing chlorine, such as PVC.[25]

- The presence of PVC in steel products leads to the release of large amounts of dioxin when these products (for example, cars) are scrapped and sent to steel mills for recycling. While metal recycling is an important and reasonable practice to cut down primary steel production and conserve raw materials, the environmental impact of steel recycling is greatly increased when scrap metal is contaminated with chlorinated compounds, including PVC plastic.[26]

Recycling cars containing PVC releases large amounts of dioxin.

- Secondary copper smelters which recycle PVC-contaminated copper scrap, such as PVC-coated cables, are a significant source of dioxin contamination in the environment via atmospheric emissions. This is partly because the formation of dioxin is catalysed by the presence of copper. In February 1988, the regional authorities responsible for licensing the Austrian copper smelter of 'Montanwerke Brixlegg AG' banned the use of PVC-containing material to cut down on dioxin emissions.[27]

- In many parts of the world, cable scrap is burned in the open air. In 1994 Greenpeace discovered that imported PVC-coated cables are recycled in the slums of Jakarta, Indonesia, simply by burning the PVC off the cables in big steel drums in people's backyards.[28]

PVC and Incineration

PVC is usually the main source of chlorine in the municipal waste stream, in the form of packaging, household products, old furniture and fittings. It is therefore the primary contributor to dioxin formation in municipal waste incinerators.[29]

A major atmospheric dioxin source is hospital incineration. In a draft reassessment of dioxin published in 1994, the US EPA listed hospital incinerators as the No. 1 dioxin source in the US.[30] Observation of the feedstock of hospital incinerators reveals PVC medical products as a major source of chlorine. PVC is used in hospitals in many disposable products such as tubing systems, blood and infusion bags, gloves and packaging. Burning these medical products leads to the release of dioxin from medical waste incinerators

> "... hospital incinerators are the No. 1 dioxin source in the US"

TABLE 2: THE NSW DIOXIN FACTORIES

COMPANY	LOCATION	FACILITY TYPE	SAMPLE TYPE	DATE & NUMBER OF SAMPLES	DIOXIN EMISSION RATE [ng ITEQ m^3]
INCINERATORS & BURNERS					
Municipal Waste					
Waverley - Woollahra ①	South Sydney	municipal waste incinerator	a) stack gas b) ambient air	1990-1994 a) 7 b) 3	a) 5
Medical Waste					
Lithgow Hospital	Lithgow	medical waste incinerator	stack gas	Dec '92 a) 1 Dec '95 b) 1	a)12.7 b) 6.57
Clinical Wastes Australia	Silverwater	medical waste incinerator	a) stack gas b) ambient air	May '94 a) 1 b) 3	a) 0.45
Other					
Waste Recycling & Processing Service of NSW	Lidcombe	thermal oil heater	stack gas	Jun '93 1	0.108
Blue Circle Southern Cement Ltd ②	Marulan	cement kiln - oil burn	stack gas	Oct '94 1	0.294
Sydney Water ③	Malabar	sewage incinerators	stack gas a) multiple hearth b) fluidised bed	Mar '95 a) 1 b) 1	a) 0.278
STEEL WORKS					
BHP	Port Kembla	sinter plant	stack gas	Feb '95- 1	2.72
BHP	Newcastle	sinter plant	stack gas	Nov '95 -3	3.48
ALUMINIUM SMELTERS					
Tomago Aluminium	Newcastle	anode plant	stack gas	Nov '94-1	0.0166
Alcan Australia Ltd	Kurri-Kurri	anode bake plant	stack gas	Sep '94-1	0.010.728
MOTOR VEHICLES					
Motor Vehicles	NSW EPA Motor Vehicle Laboratory	Petrol based motor vehicles⑤	exhaust gas a) leaded b) unleaded	Sep '94 a) 1 b) 1	a) 0.000024 b) 0.000056
Sydney Harbour Tunnel	inside tunnel	motor vehicles	ambient air	Oct '94	0.00183587
POWER STATIONS					
Pacific Power ④	Liddell	power station	waste oil & coal burn emissions	Oct '94 - Jun '95 - 4	0.016-0.049
OTHER					
Waste Service NSW	Lucas Heights	landfill duct stack	a) duct emission b) stack gas	Jun '94 a) 1 b) 1	a)0.021 b)0.005

① Figures for Waverley- Woollahra were averaged from seven samples taken between 1990-1994. Under NSW Freedom of Information legislation, dioxin sampling for 1994 was obtained by Greenpeace from the NSW EPA. Previous dioxin sampling results from 1990 was obtained by South Sydney Council from the NSW EPA. For details, see the Appendix to this report.

② Blue Circle Southern Cement Kiln sampling was undertaken for a trial test burn using waste oil which was slightly chlorinated. Blue Circle Southern Cement do not burn waste oil on an on-going basis so these results are not indicative of normal operations.

③ Malabar sewage sludge incinerator was closed on 31 October 1995 and is to be decommissioned this year.

④Pacific Power - Liddell Power Station (now owned by Macquarie Power) carried out a series of test burns using recycled sump oil. Sump oil is only used to start the power station, not as main feed. Hence it is difficult to calculate the total load or amount of emissions.

④ Leaded petrol exhaust emissions were measured from a 1983 3.3 litre 6 cylinder General Motors WB Holden Panel Van. Unleaded petrol emissions were measured from a 3.8 litre fuel injected 6 cylinder 1992 General Motors Holden Commodore Station Wagon. Both vehicles were fitted with catalytic converters and supplied with fuel from the Sydney city outlets of Shell Australia.

3. Dioxin Factories: Reported industrial releases of dioxin in NSW

Using the Freedom of Information Act, Greenpeace obtained the results of 32 dioxin test samples from motor vehicle emission tests and from 14 sites around NSW. Initially, BHP steel works in Newcastle and Port Kembla appealed against the release of the information. After discussions with Greenpeace, they withdrew their appeal and the NSW EPA released the results to Greenpeace.

Information regarding dioxin releases is not well documented, and access to the limited data available is complex, time-consuming and expensive. Accessing this information on a regular basis is beyond the resources of the average citizen. This data set represents, to our knowledge, the only comprehensive dioxin testing data for air emissions carried out in Australia.

Point source emissions

Of the 32 samples discussed here, 20 samples related to point source emissions from specific facilities, mostly taken between 1993-1996. They include: medical waste incinerators (3); municipal waste incinerators (1); sewage incinerators (2); cement kilns (1); thermal oil heater (1); steel smelters (4); aluminium smelters (2); power stations (4) and landfills (2).

In addition, results of sampling of fly ash and past monitoring of the Waverley-Woollahra Process Plant, released by the South Sydney Council, are incorporated into our results.

Six facilities currently operating in NSW were found to be releasing significant amounts of dioxin. Four of the six facilities, which recorded emissions higher than the German standard (0.1 ng m^{-3}), were combustion facilities such as municipal or medical waste incinerators (see table 3).

TABLE 3: EXISTING FACILITIES IN NSW RELEASING DIOXIN THAT EXCEED THE GERMAN STANDARD FOR AIR EMISSIONS OF 0.1 ng m^{-3} FOR INCINERATION IN DECREASING ORDER OF CONCENTRATION.

Company	Location	Facility	Annual Dioxin Output (ng ITEQ m^{-3})	Exceeds German ① standard by:
Lithgow Hospital	Lithgow	medical waste incinerator	a) 12.7 b) 6.57②	**a) x 127.0** **b) x 65.7**
BHP	Newcastle	steel works	3.48	**x 34.8**
BHP	Port Kembla	steel works	2.72	**x 27.2**
Waverley - Woollahra Councils	South Sydney	municipal waste incinerator	5③	**x 50**
Clinical Wastes Australia	Silverwater	medical waste incinerator	0.45	**x 4.5**
Waste Recycling & Processing Service of NSW	Lidcombe	thermal oil heater	0.108	**x 1.1**

ITEQ are international total toxic equivalents based on the toxicity of 2,3,7,8-TCDD (the most toxic form of dioxin)

① The German standard is used as a common benchmark by other countries for dioxin emissions to air, including sources apart from incineration.

② a & b refers to dioxin sampling undertaken in 1992 and 1995 respectively.

③ Based on average emissions between 1990-1994.

> "Six facilities currently operating in NSW were found to be releasing significant amounts of dioxin"

TABLE 4: ANNUAL TOTAL DIOXIN OUTPUT BASED ON EMISSION DATA COLLECTED IN NSW.

Facility	Stack gas flow rate m^3 min^{-1}	Annual stack output g $year^{-1}$
BHP Newcastle (average)	17754	32.5
BHP Port Kembla	20383.33	29.1
Waterloo Incinerator ①	1800	4.73
Clinical Wastes Australia	920	0.218
Lithgow Hospital	37	0.128
Tomago Aluminium	11754	0.105
Motor Vehicles (l) ②	0.81	0.0572
Motor Vehicles (u) ③	0.73	0.0332

① based on average emissions over last five years

② Motor Vehicles (l) = vehicles using leaded fuel (based on annual sales of LP in NSW)

③ Motor Vehicles (u) = vehicles using unleaded fuel (based on annual sales of ULP in NSW)

> "BHP steelworks in Newcastle was the single largest source of dioxin because of the huge volume of emissions"

Table 4 calculates the total amount of dioxin released by facilities in NSW, and illustrates the importance of calculating the *load*, or total amount, of dioxin released. For example, although the Lithgow Hospital incinerator recorded the highest concentrations of dioxin, BHP steel works in Newcastle was the single largest source of dioxin because of the huge volume of emissions.

Vehicle Emissions

Two samples related to dioxin emissions from motor cars measured under laboratory conditions, one to represent vehicles using unleaded fuel, the other to represent vehicles fuelled by leaded petrol.

Ambient and Background levels of Dioxin in Air

Ten samples related to ambient air levels surrounding particular facilities including; Clinical Wastes Australia medical waste incinerator, Silverwater (3); Waverley - Woollahra process plant, South Sydney (3); Castlereagh landfill (3); Sydney Harbour Tunnel (1).

Germany and the Netherlands have carried out testing programs in rural and industrial areas. The results of these studies suggest that, for industrialised countries, background dioxin concentrations in air are between 0.01 - 1 pg ITEQ m^{-3}.[31]

Samples from Australia were between 0.007 pg ITEQ m^{-3} in the Sydney Harbour Tunnel and 0.168 pg ITEQ m^{-3} around the Castlereagh landfill (see Table 5). It is interesting that there was less dioxin in the air in the Sydney Harbour Tunnel than around both the Silverwater medical waste incinerator and the Castlereagh landfill. Likewise, both Silverwater and Castlereagh recorded higher ambient dioxin concentrations than those measured around the Waverley-Woollahra process plant in 1990.[32]

With the exception of the Sydney Harbour Tunnel, all the ambient levels recorded are higher than standards applied by the US states of Pennsylvania and South Carolina. However, they are lower than the extremely weak NATO standard of 30 pg ITEQ m^{-3}.

" ... there was less dioxin in the air in the Sydney Harbour Tunnel than around both the Silverwater medical waste incinerator and the Castlereagh landfill."

Ambient Air (Germany & N'lands) pg ITEQ m^{-3}	NATO Standard pg ITEQ m^{-3}	US State Standards① pg ITEQ m^{-3}	Levels pg ITEQ m^{-3}	Location
Silverwater Medical Waste Incinerator				
0.01-1	30	0.030	**0.081**	Janson Pty Ltd, Silverwater
0.01-1	30	0.030	**0.069**	Telecom, Silverwater
0.01-1	30	0.030	**0.139**	George Lewis Pty Ltd, Silverwater
Waverley- Woollahra Process Plant (1990)				
0.01-1	30	0.030	**0.056-0.062**	Site A
0.01-1	30	0.030	**0.022-0.016**	Site B
0.01-1	30	0.030	**0.022-0.042**	Site C
0.01-1	30	0.030	**0.017-0.021**	Site D
Castlereagh Landfill				
0.01-1	30	0.030	**0.168**	Castlereagh Landfill
0.01-1	30	0.030	**0.041**	West Site
0.01-1	30	0.030	**0.060**	EPA, Richmond
Sydney Harbour Tunnel				
	30	0.030	**0.007-0.019**	Sydney Harbour Tunnel
① Standard applies in Pennsylvania and South Carolina				

TABLE 5: AMBIENT AIR LEVELS OF REPORTED NSW SITES AS COMPARED TO CURRENT STANDARDS FOR INDUSTRIALISED COUNTRIES.

Incinerators

Four of the six facilities which recorded emissions higher than the German standard of 0.1 ng m^{-3} were combustion facilities such as municipal or medical waste incinerators. These included two medical waste incinerators, one operated by Lithgow Hospital, the other by Clinical Wastes Australia at Silverwater in Sydney. In addition, the municipal waste incinerator, the Waverley-Woollahra Process Plant (Waterloo incinerator), and the Lidcombe Aqueous Waste Treatment Plant (Lidcombe oil heater) run by the NSW Waste Service, both had air emissions which exceeded the German standard.

Recent research suggest that dioxins in stack gases comprise only 11.2% of total dioxin emissions. In other words, these incinerators could be generating some eight times more dioxins than indicated by their stack emissions. Incineration is an end-of-pipe solution which does not solve the waste problem: it is simply a conversion process whereby pollutants are transformed and redistributed to air, water and soil.

Studies by the Danish EPA, the Dutch Environment Ministry and the US Department of Energy have all found that increasing the PVC content of wastes burned in incinerators leads to higher emissions of dioxins. In a comprehensive review of incinerators and other combustion devices, a Princeton University research group concluded that, in general, the higher the chlorine content of materials burned, the greater the dioxin output.

In March 1996, the US EPA proposed tough pollution controls to reduce hazardous emissions from cement kilns and commercial incinerators that burn toxic waste. The US EPA believes the tighter controls on incinerators and cement kilns *"will create significant incentives"* for

"... incinerators could be generating some eight times more dioxins than indicated by their stack emissions" producers of toxic waste to recycle and reduce the amount of toxic chemicals that are burnt. Dioxin and furan emissions are to be cut by 98% as part of a broader campaign to reduce air pollution from waste burning. Incinerators have been identified as a major health threat, with children the most likely to suffer from ill effects such as cancer. The major source of dioxin from waste burning has been identified as the burning of materials such as plastics that contain chlorine. In the US, it is estimated that cement kilns and waste incinerators account for 80% of all toxic waste burned, while the other 20% is burned in industrial boilers and other types of industrial furnaces. These other sources are to be addressed by a separate regulation at a later date.[33]

"Incinerators have been identified as a major health threat, with children the most likely to suffer from ill effects such as cancer."

In the UK earlier this year, Coalite Chemicals, an incineration company, was fined £150,000 and ordered to pay £300,000 costs after Her Majesty's Inspectorate of Pollution prosecuted the company for emitting dioxins.[34] The emissions from the Coalite Products plant at Bolsover, Derbyshire, came to light when the Ministry of Agriculture, Fisheries and Food banned milk sales from the area when the milk from local dairy herds was found to be contaminated with high concentrations of dioxins.[35] The company paid £200,000 compensation to the affected farmers in 1993.

Waverley-Woollahra Process Plant - the Waterloo municipal waste incinerator: Greenpeace calculations and estimates were based on NSW EPA sampling and were combined with results obtained under Freedom of Information by South Sydney Council. Seven samples of stack emissions were taken over a period of four years between 1990-1994. Dioxin emission rates of the Waterloo Incinerator range from 8 to 168 times higher than the standard of 0.1 ng ITEQ m^{-3} used in the US and Europe. Based on the WHO Tolerable Daily Intake (TDI) of 10 pg/kg body weight/day, the Waterloo incinerator has been releasing dioxins and furans that exceed the acceptable annual intake for 18.5 million people - more than the entire population of Australia.[c] This is not to say that this number of people will absorb this amount of dioxin. Obviously not all dioxin emissions will be directly absorbed by humans, rather they are spread into the wider environment and will ultimately build up in the food chain.

"Dioxin emission rates of the Waterloo Incinerator range from 8 to 168 times higher than the standard used in the US and Europe"

"... the Waterloo incinerator has been releasing dioxins and furans that exceed the acceptable annual intake for 18.5 million people - more than the entire population of Australia."

[c] For more information, see appendices: available on request.

Ban the Burn: Close the Waterloo Incinerator

To Greenpeace's knowledge, the Waterloo incinerator is the only municipal waste incinerator operating in Australia. This contentious facility has been the focus of local community and local government concerns for many years. Prior to the 1995 State election, the NSW Labor party committed itself to phasing out this incinerator. The NSW Labor Party made the following commitments:

- *Labor believes incineration is not a viable solution to the waste crisis. We will direct the EPA to prohibit the expansion of the incineration industry in NSW;*
- *Labor will establish a working party to consider options for the phase out of the operations of the Waterloo incinerator.*

In line with the NSW Government's commitment prior to the 1995 election, the Waterloo incinerator should be closed. The NSW Government has a prime opportunity to do this when the air pollution licence for the facility is due for renewal on August 13, 1996.

Dumping of Dioxin Contaminated Waste

Much of the dioxin produced from incinerators is not released to air. Instead, it is concentrated in residues from pollution control equipment. The limited data available on Australian incinerators indicates that fly ash, trapped by filters on the stack, has high levels of dioxin contamination.

Dioxin-contaminated wastes were notified in the NSW Government Gazette as "Declared Chemical Wastes" under the Environmentally Hazardous Chemicals Acts (EHCA) on 1 November 1985. The first Chemical Control Order (CCO) issued by the NSW State Pollution Control Commission (SPCC) was the CCO in Relation to Dioxin-Contaminated Waste Materials, 14th March 1986. This CCO prohibits the disposal of dioxin contaminated waste, but only with 2,3,7,8-TCDD[d] in excess of 10 parts per billion (10 ng g^{-1}), and requires a special permit for *"the processing, keeping, selling, distributing*

[d] The CCO doesn't recognise the other toxic forms or congeners of dioxin and furans, which are rated in terms of their relation to the most toxic form of dioxin, 2,3,7,8-TCDD.

or conveying of dioxin-contaminated waste materials, except in accordance with a licence issued by the Commission".[36] Any facility which undertakes any of the above activities must hold a special permit to carry them out.

The Waterloo incinerator generates 25,000 tonnes per year of ash waste. Three to four thousand tonnes per year of this waste is fly ash (as opposed to bottom ash). The only SPCC test ever carried out on the fly ash from the Waterloo incinerator was in 1990 and showed dioxin and furan concentrations yielding 359 (NATO) and 585 (Eadon)[e] ng ITEQ g^{-1} of dioxin[37] - up to 58.5 times in excess of the disposal prohibition levels set in the dioxin CCO. Even considering the 2,3,7,8 - TCDD levels alone (35.1 ng g^{-1}), it is clear that the fly ash still breaches the 10 ng g^{-1} level set in the CCO by some 351%. Despite these alarming levels, the SPCC/EPA has neglected to test for dioxins and furans since. No follow-up work was ever done and these problematic levels of contamination continue to be ignored.

Information received by South Sydney Council from the NSW EPA under the Freedom of Information Act indicates that:

- The SPCC/EPA has not re-tested the ash for dioxins and furans since late 1989, despite the very high levels found then.
- The ash is currently being dumped at the Pacific Waste landfill at Kemps Creek in western Sydney. It is being treated as hazardous waste on the basis of its heavy metal contaminants, principally lead and cadmium, which are only marginally and occasionally in excess of licence levels. No reference has been made to dioxin levels.

At present, ash from the Waterloo incinerator that is highly contaminated with dioxins and furans is being transported to landfills in western Sydney. It is likely that ash from the other medical waste incinerators is also being dumped.

Not only is the NSW Government negligent in allowing these dioxin factories to pollute the environment, they also appear unable or unwilling to enforce even their own existing Chemical Control Orders.

[e] see Definitions p.3

Dioxin wastes are highly toxic and persistent and require special procedures for handling and disposal. In the longer term, the NSW Government should seek to eliminate the production of this waste. However, in the short term, the existing stockpile of contaminated material will need to be dealt with. The NSW Government should initiate a process to have dioxin classified as a scheduled waste under the Australia and New Zealand Environment and Conservation Council (ANZECC) National Strategy for the Management of Scheduled Waste. This would put waste contaminated with dioxins and furans on a list along with wastes such as PCBs, organochlorine pesticides and hexachlorobenzene (HCB), to be disposed of under specially developed management plans currently being developed by the Federal Government.

The Hospital Dilemma: a new threat to public health

Lithgow Hospital incinerator and Silverwater medical waste incinerator were both tested for dioxin emissions. Both were found to have exceeded the German standard for emissions to air.

Lithgow Hospital incinerator

Test results from December 1992 from the Lithgow facility reported dioxin emissions as high as 12 ng m^{-3} - almost 120 times the German standard. The most recent sampling from December 1995 found that emissions had reduced but were still 65 times above acceptable limits. The consultants employed by the hospital to coordinate the sampling highlight the inadequacies of the present regulatory system. The letter states: *"... there appears to be no reason why the current facility should not be permitted to operate until such time as the Air Quality Management Guidelines are issued by the NSW State Department for the Environment"*.[38]

Biological contaminants require treatment to avoid infection. Concern about many infectious diseases, such as HIV and the hepatitis-B virus, increased the calls for incineration of medical waste. However, medical waste has a relatively low infectious content (10%) and incineration is an expensive method of disposal.

Not only is the NSW government negligent in allowing these dioxin factories to pollute the environment, they also appear unable or unwilling to enforce even their own existing Chemical Control Orders.

Lithgow Hospital incinerator reported dioxin emissions almost 120 times the German standard in December 1992

PVC-free Hospitals

A survey carried out by Greenpeace in 1994/95 of major hospitals in Austria and Germany found that hospitals had effectively substituted most PVC products. Several hospital waste incineration plants had been closed down due to excessive emission levels. The survey found that some hospitals had shifted away from PVC due to the disposal problems. The main medical objections to PVC, identified in the survey, related to the migration of the plasticiser DEHP which can cause diseases of the liver, skin and cardiovascular system. In animal experiments, DEHP has been shown to be carcinogenic.[39] New evidence is emerging to suggest that DEHP is also a hormone disrupter.

> "PVC, which is currently among the most widely used plastic in the health sector, must be phased out in all products that end up in hospital waste."

> "Dioxin emissions from steelworks accounted for over 90% of the total dioxin load in NSW."

> "The Silverwater incinerator, adjacent to the Olympic site at Homebush Bay will be an embarrassing indictment of Australia's pollution prevention record"

The first step in avoiding incineration of medical waste is to separate infectious from non-infectious waste. Waste management initiatives include implementing waste separation systems, substituting reusable and durable products for disposable ones, and introducing recycling programs for some plastics, paper and metal. PVC, which is currently among the most widely used plastic in the health sector, must be phased out in all products that end up in hospital waste. Products made of non-PVC materials exist for most medical applications.

The elimination of PVC from medical waste would reduce dioxin emissions. Likewise, there are opportunities for product substitution in hospitals and alternative disposal techniques which do not involve incineration. These technologies fall into broad categories of mechanical treatment, chemical treatment, chemical/mechanical treatment, thermal deactivation, electron beam sterilisation, electro-thermal deactivation, autoclaving and microwaving.[40]

Silverwater medical waste incinerator and Lidcombe thermal oil heater

Both the Silverwater medical waste incinerator and the Lidcombe thermal oil heater exceeded the German standards for dioxin emissions (see Table 5). The testing of ambient air carried out by the NSW EPA around the Silverwater incinerator showed relatively high background levels of dioxins compared to some US State standards (see Table 5).

These levels of dioxin emissions would not be allowed in many countries around the world. The location of these facilities adjacent to the Olympic site at Homebush Bay will be an embarrassing indictment of Australia's pollution prevention record when international attention is focussed on Sydney during the 2000 Olympics.

Cement kilns

Sampling of the Blue Circle Southern Cement kiln was undertaken during a trial test burn using waste oil which was slightly chlorinated. Blue Circle Southern Cement do not burn waste oil on an on-going basis, so these results are not indicative of normal operations.

The fairly high dioxin emissions from a low chlorinated oil (0.15% chlorine content) used in the test burn demonstrates the unsuitability of cement kilns for burning chlorinated waste. Cement kilns should not be used to burn industrial waste - particularly chlorinated waste. This position is supported by the Australian Cement Industry Federation Limited.[41]

Malabar sewage incinerators

Until 1995, Sydney Water had two incinerators to burn sewage sludge from the Malabar sewage treatment site. Both emitted high levels of heavy metals into the air. The multiple hearth incinerator also emitted unacceptable levels of dioxin that exceeded the German standard. It is interesting that the two incinerators are to be decommissioned this year due to health concerns from local residents. Clearly, if these plants were closed due to health concerns, the same standard should be applied to other incinerators which exceed internationally recognised standards.

Steelworks

Steelworks have been identified in studies since the late eighties as being a significant source of atmospheric dioxin emissions.[42] In Germany, dioxin emissions from steelworks are estimated to be potentially half of all Germany's annual dioxin emissions. Similarly in the UK, metallurgical processes, dominated by steelworks, could be responsible for up to half their known dioxin emissions.[43]

In the limited dioxin testing results available for this study, dioxin emissions from steelworks accounted for over 90% of the total dioxin load in NSW.

From studies undertaken in Germany, steel sinter plants have been identified as the major dioxin source within steelworks. Sinter plants collect undersized iron ore fines, coke breeze and waste material from other parts of the plant and preheat it to form a suitable size aggregate for the blast furnace. Dioxins that are formed in the flue gases of sinter plants are believed to come from chlorinated organics, including cutting oils, found in the waste stream. In Britain, there are already calls by the Non-ferrous Metals Federation to ban chlorinated cutting oils in order to reduce emissions from smelters operated by its members.[44]

Total dioxin emissions recorded from sinter plants at BHP Steelworks in Port Kembla and Newcastle were equivalent to more than 6 times for

Port Kembla steelworks and 7 times for Newcastle steelworks in excess of the "allowable daily dose" of dioxins for the entire population of Australia. These figures are based on the WHO TDI for dioxins.[45]

BHP Steel is currently undertaking studies of the sinter plants at both their Port Kembla & Newcastle steelworks. Dioxin emissions recorded from both sinter plants ranged from 2.72 ng m^{-3} up to 3.92 ng m^{-3}, nearly forty times over the German dioxin emissions standard for incinerators. While these dioxin concentrations appear low compared with some incinerators, the massive gas flow rate from sinter plants, typically in excess of 1 million m^3 hr^{-1}, produces very high dioxin loads. For example, the combined annual dioxin load from Port Kembla steelworks of 29.1g ITEQ and from the Newcastle steelworks of 32.5g ITEQ is almost equivalent to all the dioxin released from hospital incinerators in the United Kingdom.[46]

Secondary steelmaking or steel recycling plants such as Electric Arc Furnace (EAF) steel mills have also been identified as a major dioxin source. Scrap metal contaminated with PVC plastic and chlorinated oils, including PCBs, have been identified as the most likely cause of the dioxin emissions from these type of operations.[47] Studies carried out on an electric steel furnace in Sweden identified PVC as giving the highest dioxin emissions of all the sources of chlorine contamination of scrap metal.[48] BHP Steel currently operate a small EAF steel mill in Sydney and propose to install an EAF in place of their current steel making operations in Newcastle by 2002.[49]

In Germany, bag filters have been used to reduce dioxin emissions from sinter plants and electric steel furnaces. However, despite these efforts to reduce dioxin emissions, the high gas flow rates continue to generate significant levels of dioxins.[50] Elimination of chlorinated organics including chlorinated cutting oils and PVC from entering the steelmaking process is clearly needed to help eliminate this significant dioxin source.

Motor vehicles

A number of overseas studies have been undertaken of dioxin emissions from motor vehicles. Chlorinated chemicals, such as dichloroethane, are used as scavengers in leaded petrol.[51] They assist in the normal combustion process with dioxin formation as a byproduct.

It has also been reported that chlorinated chemicals in engine lubricant oils are a contributing factor to the dioxin content of emissions.[52,53]

A study by the NSW EPA was carried out on the exhaust emissions of both an unleaded- and leaded-fuel powered motor vehicle for the purposes of estimating the dioxin emissions of petrol driven motor vehicles. Both fuels had a chlorinated organic content below 10 μg g^{-1} so other sources of chlorine, in either the engine oils or combustion air, were suspected as being present during testing. The rate of dioxin emissions from the leaded petrol vehicle of 56 pg $litre^{-1}$ was more than twice as high as for the unleaded petrol vehicle at 24 pg $litre^{-1}$.[54]

The study showed that petrol-driven motor vehicles contribute a total of less than 0.1g of dioxins annually for NSW. Although the estimates for dioxin emissions from motor vehicles do not allow for differences in driving techniques and vehicle performance, they are indicative of dioxin emissions from petrol driven motor vehicles. Further testing needs to be undertaken to determine the dioxin contribution from diesel driven vehicles to determine the overall dioxin load from the road transport sector. The low levels of dioxins measured from motor vehicle emissions in this study certainly contradicts industry claims that motor vehicles are a significant dioxin source.

Lucas Heights landfill stack and duct gas

Dioxin emissions from the Lucas Heights landfill were measured from ducts and stacks used to capture methane for use in power generation. Levels were relatively low, though higher than background levels. No information was available about the output of stack gas so the total dioxin emissions could not be calculated.

BHP Port Kembla & Newcastle steelworks "recorded nearly forty times over the German dioxin emissions standard"

"These dioxins will enter the local and global environment and return to us via the food chain at a later date. They will be untraceable, and no one will be able to identify or take action against the polluters."

"Regulation of dioxin is virtually non-existent in Australia. Except for occasional, ad hoc monitoring by agencies like the NSW EPA, dioxin pollution happens in secret, without public scrutiny."

Power stations

The emission samples from the Liddell Power station related to a trial burn of waste sump oil. During the burn, 84.6 tonnes of waste oil and 651 tonnes of coal were burned. Gas was measured for dioxins and furans, heavy metals and polyaromatic hydrocarbons (PAHs). It was surmised that low levels of dioxins can be expected in emissions from power stations due to the low levels of chlorine present in the fuel.[55]

Dioxin emissions from the power station were significantly lower than the European standard of 0.1 ng ITEQ m^{-3}. The waste oil was only used in the start-up of the station and not as a main fuel source. No figures were provided on mass flow rate and duration of start-up, so the actual dioxin load could not be calculated. The level of PAHs, according to the consultants, were *"somewhat higher than expected"*.[56]

Aluminium smelters

Samples from the anode bake plant stacks of two aluminium smelters, Alcan Australia (now Capral Aluminium) Ltd, and Tomago Aluminium, were analysed for emissions of dioxins and furans. The Alcan plant samples were also analysed for PAHs. Both furnaces are natural gas fired. Although the levels of dioxins and furans were relatively low in terms of concentrations, the flow rate and volume of the plants make them significant sources of dioxin. The estimated total amount of dioxin released by Tomago Aluminium is almost the same as that released by the Lithgow hospital incinerator, which had emission levels 65 times the German standard.

Dioxin emissions from the Alcan smelter were only half those of Tomago, and considerably less than leaded petrol vehicles in NSW. It is possible, however, that like incinerators only around 11% of the total dioxin emissions from the aluminium smelters are being captured during testing.

Stop Secret Pollution: eliminate dioxin and legislate a National Pollutant Inventory

The results obtained from patchy emissions testing data in just one Australian state should be a considerable cause for concern. The regulators, in particular, have failed in their task, which is primarily to protect the environment and the health of the population. They are unable to estimate the risks due to the lack of quantitative and toxicological data.

These dioxins will enter the local and global environment and return to us via the food chain at a later date. They will be untraceable, and no one will be able to identify or take action against the polluters. Not all potential sources have been identified, and the majority of effort has been directed at emissions to air. An unsystematic approach leads to gross underestimation of the total discharges, and fails to address discharges to all environmental media, ie air, water and land.

Regulation of dioxin is virtually non-existent in Australia. Except for occasional, ad hoc monitoring by agencies like the NSW EPA, dioxin pollution happens in secret, without public scrutiny.

The community has a right to know about dioxin and other toxic pollution. We need national legislation which requires companies to report pollution to a national, publicly accessible, computerised database or pollutant inventory.

Studies carried out for the Federal EPA have demonstrated the poor quality of environmental monitoring in Australia. The study of data sets from state EPAs reaffirmed that there is relatively little monitoring of releases of hazardous and toxic chemicals into the environment. Only a handful of chemicals are monitored and there is very limited public access to the results.[57]

A report prepared by the Federal Government on Australia's urban air quality made the following observation: *"...Australia's urban air quality management/assessment is uncoordinated, lacks a national perspective of focus and direction, utilises resources inefficiently... there is a tendency for duplication and a pronounced weakness in our ability to interpret the data collected"*.[58]

A nationally legislated National Pollutant Inventory would ensure that information about releases of toxic pollutants, including dioxin, to all environmental media is collected uniformly across the country. Development of a comprehensive NPI is a critical step in addressing Australia's pollution problems by promoting pollution prevention.

It is becoming clear that Australia has not escaped the impacts of chlorine chemistry. Australia must look to the source of pollution to prevent present pollution and health problems. Of particular concern are the sublethal health effects, ie those which affect development, reproduction and immunological capabilities. The lack of background data, for example of body burdens of dioxin in the Australian population, is irresponsible in the light of the serious health and ecological implications. Australian governments should urgently develop a strategy to eliminate dioxin.

> "Australian governments should urgently develop a strategy to eliminate dioxin."

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4. Towards Eliminating Dioxin

International Agreements in the Regulation of Dioxin

As part of the implementation of the Earth Summit Agenda 21 (Rio de Janeiro, Brazil, June 1992), an Intergovernmental Conference for the Protection of the Marine Environment from Land-Based Activities took place in Washington, D.C., from October 23 to November 3rd 1995. At this meeting, over 100 countries, including Australia, signed the Washington Declaration, a political statement by governments which highlights key elements in the detailed Global Program of Action to eliminate toxic substances from the world's oceans.

The meeting identified 12 priority substances, all of them classified as persistent organic pollutants (POPs), for elimination, including dioxins and furans. The Washington Declaration commits governments to the *"reduction and/or elimination of emissions, discharges and, where appropriate, the elimination of the manufacture and use of POPs."* The list of 12 POPs targeted for action are all organochlorines, and are either pesticides, industrial chemicals or unintentional byproducts. Dioxins fall into the latter category.

At a follow up meeting in Canberra, Australia, in March 1996, the Intergovernmental Forum on Chemical Safety confirmed international support for the development of a legally binding instrument to phase out the 12 POPs. The meeting also recommended the development of pollution inventories as important tools in preventing pollution.

Also at the global level, but with fewer contracting parties, is the 1993 resolution of the International Whaling Commission. The resolution called for efforts to eliminate the emission or discharge of organohalogens[f] into the marine environment.

[f] Organohalogens are a broader class of chemicals which include the organochlorines.

Regional Initiatives to Eliminate Dioxin Discharges

Prior to the Washington Declaration, a number of regional agreements had already targeted organochlorines, including dioxin, for action, with some setting specific timelines for reduction and elimination. They include:

- Barcelona Convention - Mediterranean Sea
- North Sea Conference
- OSPAR (Oslo-Paris) Commission - North East Atlantic
- International Joint Commission - Great Lakes (USA & Canada).
- Nordic Council - Arctic region

National Action to Manage Dioxin Emissions

Several national governments have intensively sponsored dioxin research, mostly during the last two decades. The most extensive is the US EPA reassessment of dioxin. As a result, the US has taken several legislative initiatives to protect humans and the environment.[59]

However, the US, and other countries with voluntary and legislated standards for dioxins in environmental media and food intake, do not seek to eliminate dioxin. They are regulatory measures designed to manage releases into the environment and uptake from the food chain.

Dietary Intakes

As well as developing standards for dioxin emissions, many countries use dietary intake to assess or manage exposure to dioxin. Some countries use different methodologies to develop these standards.

Definition of the Precautionary Principle

In Article 2 of the OSPAR (Oslo & Paris) Convention, the signatories agreed that:

The contracting parties shall apply:
The precautionary principle, by virtue of which preventative measures are to be taken when there are reasonable grounds for concern that substances or energy introduced, directly or indirectly, into the marine environment may bring about hazards to human health, harm living resources and marine ecosystems, damage amenities or interfere with other legitimate uses of the sea, even when there is no conclusive evidence of a causal relationship between the inputs and the effects.

From: "Taking Back Our Stolen Future", Greenpeace International, April 1996, p8

TABLE 6: DIOXIN GUIDELINES FOR EMISSIONS TO AIR

Country	Type of installation	Max allowable concentration ng ITEQ m^{-3}
Germany ①	municipal waste incinerators ②	0.1
Japan	newly installed incinerators only	0.5
Netherlands ①	all incinerators	0.1
Sweden	municipal waste incinerators	0.1-0.5
United Kingdom	new incinerators ③	0.1
United States	hazardous waste incinerators	0.1

ITEQ are international total toxic equivalents based on the toxicity of 2,3,7,8-TCDD (the most toxic form of dioxin)

① enforced by legislation

② The German standard is used as a common benchmark by other countries for dioxin emissions to air, including from other sources apart from incineration. Similar standards are being discussed for exhaust gases from steel mills and metal reclamation operations.

③ The UK has set an achievable target of 1 ng m^{-3} with a proposed design target of 0.1 ng m^{-3}

TABLE 7: DIOXIN DIETARY INTAKE CRITERIA

Country	Milk and dairy products pg ITEQ g^{-1} milk fat	Fish pg g^{-1} wet weight	ADI pg kg^{-1} body weight/ day
Canada		20 ①	10
Germany	5 ②		1-10 ③
Japan			100 ④
Netherlands	6		4
Sweden		⑤	5
UK	17.5		10
US		25	0.006 ⑥ 0.01 ⑦
WHO			10
Australia			10

ITEQ are international total toxic equivalents based on the toxicity of 2,3,7,8-TCDD (the most toxic form of dioxin)

①Great Lakes area

②German authorities have set a preferable target of 0.9 pg ITEQ g^{-1} milk fat

③The German government has set the goal of reducing human intake to below 1 pg kg^{-1} body weight/day.

④This value, which was used in a heath risk assessment of a municipal waste incinerator, is the only Japanese criterion that has been set to evaluate risks of human exposure.

⑤National Food Administration is considering recommending that pregnant women avoid certain fish species from the Baltic Sea, and that dieting after the birth could lead to increased levels of dioxins, furans and PCBs in breast milk.

⑥Rather than an acceptable daily intake, the US Environment Protection Agency has established a risk-specific dose or virtual safe dose - based on the daily intake which over a life time is associated with a cancer risk of one in a million.

⑦In its current draft dioxin reassessment, the US EPA has proposed this slightly relaxed risk specific dose of 0.01 pg kg^{-1} body weight/day, although it is likely that this is far less than people currently consume.

"Regulators and industry may have to accept that there are no safe doses for many of the chemicals that are produced."

No Safe Dose

Many current regulations designed to protect human health are based on risk assessment, which attempts to determine 'safe' doses of individual chemicals - doses which will not cause 'unacceptable' levels of clearly identifiable health effects such as cancer. This is a permissive approach which attempts to identify how much pollution you can expose people to without making too many of them ill.

The same approach is used when pollutants are released by industrial processes into the environment. Again, the assumption made is that there is a 'safe' level of pollution that the environment can cope with. These 'safe' limits also don't take into account the total release of pollutants throughout the life cycle of a product - from production, through to its use and ultimate disposal.

Regulators and industry may have to accept that there are no safe doses for many of the chemicals that are produced. New strategies are needed, based on the precautionary principle, which calls for preventive action against chemicals where there is any evidence of harm. It means that all efforts should be taken to prevent the release of these chemicals into the environment, particularly those like dioxin which persist and build up in human bodies, and can therefore be passed on to the next generation. In practice, this will often mean ceasing their manufacture or use altogether.

Increasingly, the precautionary principle is being adopted as a policy instrument by governments around the world.

Regulation of Dioxin in Australia

Australian industry has embraced chlorine chemistry, and uses a range of industrial processes which are known to produce dioxins and related chemicals, most notably the PVC industry. Based on available information, it seems that chlorinated products in the form of pesticides and PVC are contributing to contamination of the Australian environment. In particular, dioxins are contaminating our sewage and marine environments through the practice of industrial waste discharges to air and water. Information on these dioxin sources is sketchy, and routine monitoring is negligible.

International recognition of dioxin and related compounds as persistent organic pollutants, coupled with the US EPA's reassessment of dioxin, means that dioxin and related substances must be eliminated. Australian governments have already acted to curb the use of other chlorinated substances for which there were concerns regarding human health and the environment, such as DDT, PCBs and the cyclodiene pesticides, including heptachlor and chlordane.

Australian authorities have adopted the WHO standard for Tolerable Daily Intake (TDI) which is 10 pg kg^{-1} body weight/per day. This is 1670 times higher than the existing US standard of 0.006 pg kg^{-1} body weight/day. There is, however, virtually no information regarding the levels of dioxin in the Australian population. There is no reason to expect that the sources and impacts of dioxin and other chlorinated compounds will be significantly different in Australia compared to other industrialised nations.

The expert reference panel appointed to review studies of the environmental impact of the chemical company, Nufarm Ltd, commented on the levels of dioxin in the Australian population: *"Ideally, one would like to have values for the Australian population. These are not presently available, but there is no reason to expect them to differ from those of North American and European residents".* [60]

Neither the NSW EPA nor any other Australian Authority has a legally enforceable standard for dioxin emissions. However, as a rule of thumb, the NSW EPA applies the German standard of 0.1 ng m^{-3} for dioxin emissions to air. The lack of regulation regarding dioxins may result in our producing comparatively more dioxin emissions per head of population than other countries.

In 1991, ANZECC identified incinerators in Australia as a possible source of dioxins: *"In Australia, municipal waste is not burnt on a comparable scale to Canada or Sweden, and is not likely to be a major source but could be a significant local contributor. Recently, concerns have been expressed about emissions of dioxins from a municipal incinerator in Sydney. The operating conditions needed to control and minimise the release of dioxins from municipal or hospital waste incinerators are rapidly being defined."* [61]

However, over five years later, Australian governments are seemingly little closer to eliminating dioxin pollution.

In contrast, Australia's closest neighbour, New Zealand, has already established an organochlorine programme which seeks: "*To develop ... National Environmental Standards for dioxins in the media of air, soil and water ...*" and "*to identify and develop as far as practicable, the elements of an integrated management strategy for dioxins.*" To achieve this objective, the New Zealand Government is carrying out a dioxin sampling programme to determine sources and ambient levels of dioxins in New Zealand ecosystems, food products and the human population. [62]

"The lack of regulation regarding dioxins may result in our producing comparatively more dioxin emissions per head of population than other countries."

5. Greenpeace Demands

To Industry:

Phase out sources of chlorine

1. BHP and other steel producers and recyclers should identify all potential dioxin emissions and institute plans for eliminating dioxin emissions. This should include:

- Ceasing the use of chlorinated oils
- Eliminating PVC and other chlorinated materials from feedstocks
- Supporting and implementing a PVC phase out
- Supporting a fully legislated National Pollutant Inventory

2. Incinerator operators should eliminate inputs of chlorinated products from the feedstock.

To the NSW Government:

1. Ban the Burn: Close the Waterloo Incinerator.

Greenpeace calls on the NSW government to withdraw the Waterloo incinerator's air pollution licence and close the facility by August 1996.

2. Stop Dioxin Dumping.

The dumping of dioxin-contaminated waste should cease immediately. Elimination of the contaminated waste stream via product and process distribution should be the primary method in achieving this. Until this can be achieved, dioxin-contaminated wastes should be treated by appropriate closed-loop technologies, or stockpiled in above ground secure storage until appropriate detoxification or stabilisation methods are developed.

The NSW Government should propose that dioxins be classified as scheduled waste under the ANZECC National Strategy for the Management of Scheduled Waste. This would put waste contaminated with dioxins and furans on a list along with PCBs, organochlorine pesticides and HCBs, to be disposed of under a specially developed management plan.

3. Medical Waste Review.

The NSW Minister for the Environment should initiate an Industry Waste Reduction Plan (IWRP) for hospital and medical waste using the Waste Minimisation and Management Act 1995. Its goal must be the elimination of the sources of hazardous by-products from the disposal of medical waste, and phase out the practice of medical waste incineration.

"... dioxins should be classified as scheduled waste ... to be disposed of under a specially developed management plan."

4. PVC Phase-out.

- Hospitals should seek to eliminate, substitute or phase out PVC products.
- Extend the scope of the Sydney 2000 Olympics environmental commitments.
- Prepare a timetable for the phase out of PVC plastics in all applications.

5. Zero Dioxin: Program of Action.

The NSW and other Australian governments need to act quickly to reduce dioxin emissions. As a priority, they need to:

- Identify all dioxin sources;
- Set a zero dioxin discharge level for all emission sources.

To the Federal Government:

1. Stop Secret Pollution: Legislate a National Pollution Inventory - Now !

Greenpeace calls on the Federal Government to implement National Pollutant Inventory and Community Right To Know legislation. This legislation should require:

- Uniform national legislation, as opposed to nine separate pieces of State and Federal legislation;
- Full Commonwealth funding for implementation ($5 - 10 million per year);
- A starting list of around 100 substances, with provisions for expansion over the next three years;
- Reporting of pollutants to all environmental media including air, land and water, and the fate of trade wastes and hazardous pollutants when transferred off site;
- Reporting of both point sources of pollution, such as individual factories or government agencies, and diffuse emissions like motor vehicles. In the longer term, diffuse sources should also include agricultural chemicals such as pesticides;
- Legislated right to straightforward, open access to information for all members of the community;
- An open and clear procedure for dealing with claims of commercial-in-confidence by industry;
- Large fines and penalties for false or non-reporting by industry;
- Third party rights for community groups to ensure compliance with the legislation;
- Application of the precautionary principle in the listing of reportable substances.

2. Elimination Strategies - break the toxic cycle:

The only answer to toxic pollution is to eliminate it. Australian governments should:

- Honour international commitments made under the Washington Declaration and set priorities and timetables for dioxin elimination;
- Adopt a zero discharge policy for all toxic, persistent and bioaccumulative substances entering the environment;
- Develop national toxic use reduction legislation to progress the phase out of persistent and bioaccumulative substances, and promote clean production;
- Eliminate industrial discharges into the sewage system to force the development of reuse strategies for waste;
- Introduce a tax on toxic use, to fund the development of clean production alternatives;
- Introduce "extended producer responsibility" legislation to enforce the "polluter pays" principle.

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6. Personal Action: What you can do!

Write, fax and phone:

The Federal Minister for the Environment: Demand a legislated National Pollutant Inventory with third party rights and community right to know.

Address:	**Parliament House, Canberra ACT 2600**
Phone:	**(06) 277 7640**
Fax:	**(06) 273 4130**

The NSW Minister for the Environment: Demand a state-wide PVC phase-out and dioxin elimination program.

Address:	**Parliament House, Sydney NSW 2000**
Phone:	**(02) 9233 4044 or 9230 2115**
Fax:	**(02) 9233 3671 or 9230 2469**

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There is an Appendix to this report containing the sampling data from the NSW EPA. This document is available from:

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